

Unmanned Aircraft over Georgia Tech

March 16, 2009

Assoc. Prof. **Eric N. Johnson**, Aerospace Engineering &
Dir. of Emergency Preparedness **Andy Altizer**, Georgia Tech Police Dept.



Georgia Institute
of Technology

UAV
Research Facility



Introduction: The UAV Research Facility

- Georgia Tech and its partners have developed sophisticated flight control systems for unmanned aircraft over the past 15 years
- Recent advances in sensor and battery technologies have enabled a small Unmanned Aerial Vehicle (UAV) that is effective for short-range surveillance



Georgia Tech's Yamaha RMAX: GTMax



- More than 450 test flights since March 2002
- 70kg, 3m rotor

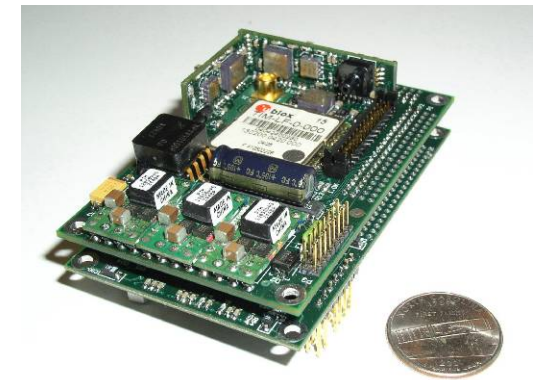
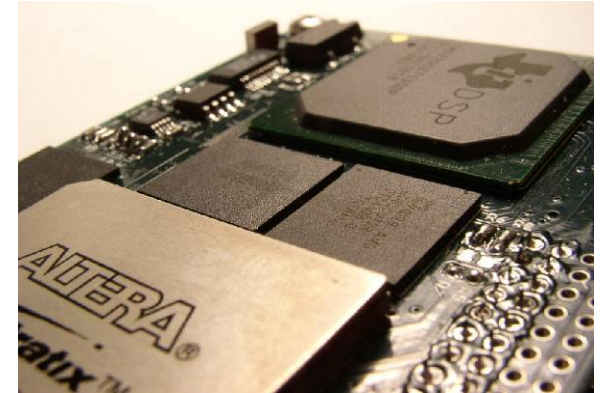


GTMax searches McKenna
(playback 5x speed)



Flight Control System 20 (FCS20): A Miniature Autopilot

- Integrated Flight Control System
 - Guidance, navigation, control, communications
- 55mm x 85mm x 30mm, 80g
- Processing, 6 GFLOPS
 - DSP is optimized for fast floating point operations
 - FPGA enables fast, parallel and flexible IO interface
- Sensor
 - IMU, Air Data, GPS

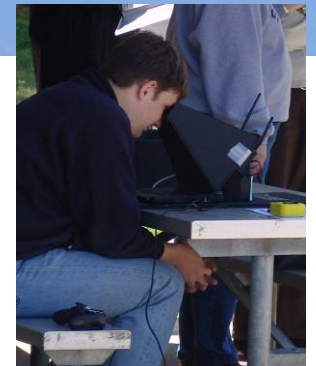


The Big Idea

- FCS20 can provide high performance control of many aircraft types
- Electric helicopters have been developed for hobbyists with impressive payload and endurance – at very small sizes
 - Low noise, minimal hazard
- Put it together: A new tool for the surveillance
 - Compared to existing small unmanned aircraft: stop and stare, high-resolution imagery, operate at low level and in urban areas
 - Compared to existing VTOL systems (Ducted fans): quiet, light-weight, less expensive, high-resolution imagery, handle more wind

FCS20 + Logo Electric Helicopter

- 4kg electric helicopter: Logo
- FCS20 avionics
- New camera slewing interface – “fly the camera”
- Used in First Responder competition in early 2007



Adaptive Flight, Inc.

- Formed in late 2005, a Georgia Tech “spin off”
 - Ron Tolliver, CEO
 - Founders:
 - Henrik Christophersen
 - Dr. Eric Johnson, Georgia Tech Associate Professor
 - Wayne Pickell
- Purpose: Commercialize several key technologies developed at Georgia Tech
 - License agreements over hardware designs and software copyrights
 - Receiving funding and other support from state of Georgia (VenureLab)



The *Hornet Micro* from AFI

- Smallest known autonomous helicopter (1 Kg)
 - Small enough to represent a low risk to persons and property on the ground and in the air
 - More likely to be approved by the FAA for operation within a defined and restricted area at low altitude
 - Can put cameras in places no other known system can reach safely
- Easy to fly with standard game controller
 - Flight modes: Preprogrammed or Joystick (stabilized position control)
 - Semi-autonomous mode most useful in urban terrain
 - Commands: Up/Down, Turn left/right, Forward/Back, Takeoff/Land
 - Interface similar to a 3D video game

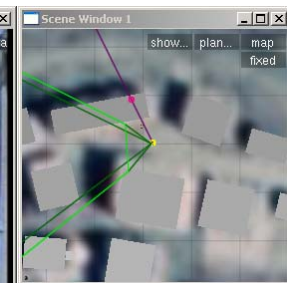


Hornet Micro: How to Fly It

- Joysticks can be used to move position and heading
 - Like a video game
 - Sticks centered gives stable hover at current position
- Can adjust position by clicking and dragging on map
- Fly waypoints
- Auto takeoff/landing



Video with Status Overlay



Map



Useful for Law Enforcement

- Inspect suspicious vehicle, inspect suspicious object
- Inspect otherwise inaccessible objects/structures
- Locate threats, follow individuals on foot
- Document area for planning during incident:
 - Entry points and escape routes
 - Locations of hostages, threats, and trapped civilians
- Document incident location for evidence
- Crime deterrent

- Note: Useful for organizations currently with or without manned aviation units

GT Police Department Perspective

- Use during home football games
 - Monitor outside activities; Respond to problem areas
 - Monitor traffic, and adjust traffic plans based on surveillance
 - Part of Random Antiterrorism Measures Program (RAMP)
- Use during other special events (road races, outdoor activities, new student move in, etc)
- Day-to-day Operations
 - Respond to fast paced crime reports (example: Entering Auto)
 - SWARM anticrime program
- Special Operations & Homeland Security
 - Eyes on the target
- Response & Recovery Operations



What are the Legal Barriers?

- Must be able to operate in airspace governed by the Federal Aviation Administration (FAA)
 - Current regulations do not effectively address or allow these types of vehicles to operate
 - New rules are under development/consideration that would enable small unmanned aircraft to be operated in civilian airspace – but the pace is slow (could be several years)
- There is a way to do it now, within current rules...
 - FAA has unofficially encouraged us to take this approach, after seeing demonstration of the system earlier this month

Certificate of Authorization (COA)

- Only a government entity can request
 - Georgia Tech Police qualifies
- Authorizes (a) particular location(s), vehicle(s), and operator(s)
- A commercial entity can be involved in any way, but the government entity must actually make the request
- This process allows practical operations of these types of systems for government/civilian applications now

A Task Force Created

- GT Police, GT UAV Research Facility, and AFI working together on the first operational use of UAVs for local law enforcement
 - Obtain COA, address other regulatory issues
 - AFI and UAVRF does FAA paperwork, answers technical questions
 - GT Police: Endorses activity, facilitates communications with FAA during COA process
 - Identify funding sources for initial use / trials of such a system
- Our Vision: This is the right place and the right time to lead the world in the use of unmanned aircraft for local law enforcement and commercial use in general

Notional Program Outline

- **Phase 1: Initial Trial**
 - Perform a series of tests of the Hornet Micro system, cooperative effort between GT Police, UAVRF, and AFI
 - Single COA to cover, notionally 6 months in duration
- **Phase 2: Initial Operational Use**
 - Purchase or rent three or more Hornet Micro systems
 - GT police certified as operators
 - (based on results of phase 1) Either based in a central location or operated out of vehicles
 - Single or more COAs to cover, notionally 18 months in duration
- **Expected Outcomes:**
 - Highly influential effort in the operation unmanned aircraft in civilian airspace, use of unmanned aircraft by law enforcement
 - Establishment of major new market segment for GT technology and a new tool for law enforcement

The Quadruple Benefit

- For Georgia Tech: Enhance response, crime deterrent, and special event force multiplier (especially home football games)
- For Georgia Tech: Transition of GT-developed technology, looks great to future sponsors
- For Georgia: Help create a new market and place a GT-spinoff company in the lead
- For the Nation: Spearhead the commercial use of unmanned aircraft in the United States, opening up a huge potential worldwide market

Funding

- We are exploring federal grants
- Does it make sense for the Institute itself to go ahead regardless?
 - The benefits to multiple groups on campus are great
- Would this be interesting as the basis for a grant or gift to the institute?
 - Make the campus safer, improve Georgia Tech reputation, and be behind an important “first” in the use of unmanned aircraft to help society

Hildebrand, Shelley Elizabeth

From: Altizer, Andrew A <andy.altizer@police.gatech.edu>
Sent: Wednesday, October 17, 2012 3:27 PM
To: Hildebrand, Shelley Elizabeth
Cc: rob connolly; Lisa Grovenstein
Subject: Fwd: COA Application for UAS operations at the Georgia Tech Campus
Attachments: Georgia Tech PD Denial Letter Hornet Micro UAS.pdf

Here's the official denial....

From: "Steven CTR Pansky" <Steven.CTR.Pansky@faa.gov>
To: "andy altizer" <andy.altizer@police.gatech.edu>
Cc: "Randy Willis" <Randy.Willis@faa.gov>
Sent: Monday, March 8, 2010 2:18:17 PM
Subject: COA Application for UAS operations at the Georgia Tech Campus

Mr. Altizer:

This letter is to inform you that your application for a Certificate of Waiver or Authorization (2009-ESA-51) for Unmanned Aircraft Systems (UAS) operations at the Georgia Tech Campus has been disapproved. After review of your application, it has been determined that your operation presents an unacceptable high risk to the National Airspace System (NAS) Specifically;

The Hornet Micro is not equipped with an approved sense-and-avoid system and risks appear to not be adequately mitigated.

There is a major Visual Flight Rules helicopter route that runs up and down Interstate 75/85. In addition, these helicopters fly over the proposed operating area.

The proposed area of operation is located in a very high aircraft traffic area which underlies the Atlanta Class B airspace. There are 2 dozen heliports in a 10 mile radius of the proposed operating area.

The proposed area of operation is located within 10 miles of 4 tower/instrument flight rules airports to include Atlanta Hartsfield.

The proposed area of operation is located in a highly populated setting.

The UAS does not meet the transponder requirement for Title 14 of the Code of Federal Regulations part 91.215(b)(2).

A signed copy of the attached letter will be sent to your mailing address.

Should you have any questions, I can be reached at (775)-815-3606 or via email at Steven.ctr.Pansky@faa.gov.

Sincerely,

Steve Pansky
Systems Engineer / Air Traffic Consultant
General Dynamics Information Technology supporting
Federal Aviation Administration
Unmanned Aircraft Systems- AJR-36
775-815-3606
Steven.ctr.Pansky@faa.gov